## SOME INSTANCES OF UNSCIENTIFIC ADMINISTRATION.

IN recent letters to NATURE and the *Times*, I had occasion to criticise the lack of science displayed by the Indian authorities during their conduct of the operations against plague in the great outbreak of 1896. The Editor of NATURE, who has so frequently and ably urged the claims of science on the public, now asks me to give any more instances of the same nature which I may have observed.

Probably few any longer accept the teaching of Hume, that the object of government is no other than "the distribution of justice." The function of an ideal civilised government might be described as the performance of all acts for the good of the public which individual members of the public are by themselves unable to perform—that is, the organisation of public welfare. The individual can certainly add much by intelligence and virtue to his own welfare; but these qualities do not suffice to protect him altogether against those evils which can be combated only by concerted action, such as the depredations of disease and of external and internal human enemies; and where he is powerless, the Government, and only the Government, can help him. Now such concerted action is likely to be successful only when it is based on sufficient knowledge; and a scientific administration differs from an unscientific one just in this particular, that it seeks the necessary knowledge, while the other acts blindly. In nothing is this more manifestly the case than in connection with that departmen of public administration which is charged with the protection of the public against disease—a department second to none in importance, because it concerns not only our sentiments and our pockets, but our health and our lives. Before such protection can be obtained, two things are absolutely necessary—first, an exact knowledge of how diseases are caused and how best they may be checked, and, secondly, an efficient organisation to act upon that knowledge when it is obtained. I will now try to examine how far, within the range of my own subject and experiences, this ideal of a scientific administration has been reached.

My experiences commenced in the Indian Medical Service in 1881. The Indian governmental machine is a bureaucracy placed mostly in the hands of soldiers and Indian civilians, who are selected from the British middle-classes by competitive examinations in branches of knowledge among which (be it noted) science, except mathematics, does not hold a very prominent position. The medical establishment, to the care of which the health of about three hundred millions of people is mostly entrusted, is divided into a civil and a military branch with corresponding duties, and contains, I think, more than a thousand qualified medical men, chiefly British, belonging to the I.M.S. and R.A.M.C., with a large subordinate staff of apothecaries, hospital assistants, and so on. The heads of this organisation are medical men, but they do not generally, I think, have seats on the supreme executive councils.

When I entered the I.M.S. it had a great reputation, which it still possesses, and, together with the Army Medical Department, had done fine work. Both these services were on the whole very well organised; but I could not help noticing several anomalies. Many of the Indian diseases are, of course, different from those met with at home. Our knowledge of them was then chiefly in the clinical stage, and very insufficient, both for treatment and prevention; and what we possessed was due, not to any organised official inquiries, but to the efforts of individuals. I remember being struck even then with the absence of organised research. It is true that pathological laboratories existed in the universities (under men burdened with other duties); that Government had specially appointed two commissioners, Lewis and Cunningham, to study this subject; that temporary inquiries had been made on leprosy and on certain local outbreaks; and that there was a good Indian medical journal; but these were obviously insufficient to enlighten us on the multitude of strange and mysterious diseases we were called upon to deal with. Why did not Government carry on much more extensive researches? The time-worn answer always was, because they could not afford it. But, surely, if they could afford such a large and expensive medical establishment, they should also be able to afford those researches which were essential to making that establishment effective. Of what use was the one without the other? An inefficient machine is the most expensive of all. Did they think that we medical men should know all about these diseases by intuition? But no!—content with having appointed a legion of "doctors" to fight disease, they never seemed to consider that it was necessary for those doctors to know how to do it.

But this invariable cry of "no funds" was palpably untrue. Many of the administrative and judicial offices in India were being paid above their market value, and were of little public importance compared with medical research. Huge sums, which would pay for such research for years, were being spent on engineering works of only local value. Even within the medical budget, money was being wasted on certain sinecures and useless administrative posts. Indeed, logically it would have been wise in the Government to sacrifice almost anything in the department in order to obtain the necessary information about disease, for the simple reason that without such information the work of the department was largely useless—the old castor-oil treatment and conservancy-cart sanitation had their limits! But what struck me most was the fact that Government failed to make use of literally hundreds of potential investigators whom it could have set to work for almost nothing. The medical services in India must be always kept on something approaching a war footing—that is to say, with a staff in excess of peace requirements. In other words, there must always be a large number of medical men, generally juniors, who in times of peace have little to do and are employed doing it in the military hospitals. I was one of these for about twelve out of my eighteen years' service, and therefore know the facts about which I write. For most of this time my official duties occupied me for less than, say, two hours a day, and I knew scores of my colleagues who were equally busy—we amused ourselves for the rest of the time. Now why did not, and why does not, the Government make use of all these men for investigation? Young, ardent, vigorous, intelligent, "spoiling" for work they were, and are, of the stuff that is now doing most of the scientific work of the country—precisely the same as those who have been labouring in my department in this university—who have even sacrificed their lives for Athena Hygieia. They had, and have, leisure and opportunities unparalleled. A microscope, a few test-tubes, a word from the chief, a little approbation, some evidence that scientific work leads, if successful, to preferment, and the authorities could have had almost for nothing scores of enthusiastic and, I will expressly add, capable workers for the great cause of medical science. But the pigeon-holed report and the official snub awaited us, and we returned disappointed to our idleness.

It is advisable to emphasise this point, because it illustrates the brainless character of much of the administration. In 1884 (I think) I asked my chief

if he would like me to investigate fevers during my abundant leisure; he replied that my duty was not to investigate, but to cure—as if we could do the second without the first! Many men have told me that they have received similar replies, and two brothers of mine quite rightly left the naval medical service because of this attitude in the authorities. A man who discourages enthusiastic juniors from doing gratuitous work in addition to their duties must be a fool of a very advanced type, and it is surprising that such men should ever be able to find their way into administrative posts. In addition to the actual discouragement of voluntary research (which I will discuss further presently), the organisation made no adequate provision to ensure scientific efficiency in the staff. There were no examinations for promotion. Leave and opportunities for study could scarcely be obtained, and even now there are difficulties—see, for instance, *British Medical Journal*, May 11, 1907, p. 1156. That first essential, recent scientific literature, was most difficult of access, and the authorities still seem to have made no adequate attempt to improve matters in this respect. Microscopes and bacteriological apparatus were generally wanting, although they are absolutely necessary in tropical clinical practice for the detection of numerous parasites, and this fault has not even yet been entirely removed, to judge by the report of the Army Medical Department for 1905, p. 224. The heads of the department frequently showed ignorance of recent scientific advances, as was apparent from their antiquated statistical methods and regulations for dealing with epidemics and their general lack of ideas; and, lastly, the annual "Records of Service" of officers, upon which their preferment was supposed to be based, was a hopelessly stupid form which made no attempt to distinguish their real scientific and professional ability—so that, as everyone remarked, appointments, like kissing, went by favour!

About the year 1880 occurred that important epoch in human history when we first learned the nature of the great transmissible diseases which afflict us—when Koch and Laveran threw open the gates of medical bacteriology and protozoology, and special laboratories sprang up everywhere in Europe and America, and even at last in Britain. As may be supposed from the foregoing, India was not in haste to follow, and the authorities, who had done so little for research themselves, did not trouble to utilise the researches of others. In 1883 Koch discovered the cause of cholera, that scourge of India, and the discovery should have been immediately followed by numerous official investigations. But, though the disease destroys about half a million people annually in India alone, little was done in that country, and neither the Government nor the people have, I believe, ever taken the trouble to thank Koch for his work. Ten years later, however, Hankin, of Agra, carried out his admirable researches on the mode of propagation, and enunciated his method of prevention by the treatment of wells. This again should have received close official scrutiny with a view to its general adoption or rejection, but from recent reports it appears to be still *sub judice*—as if it were not worth troubling about; and no one has ever dreamed of acknowledging indebtedness to Hankin. Tyhpoid, perhaps the principal enemy of Europeans in India, has never received adequate official inquiry as regards its modes of propagation in that country, and the discoverer of the prophylactic no longer enjoys State employment.

An amœba which is probably the cause of one form of that important disease, dysentery, was well studied for the Indian Government by Cunningham long ago, but the matter was not followed up. The cause of another form was discovered by Shiga in Japan. Some of the most prevalent and distressing complaints in many parts of India are those caused by *Filaria bancrofti*; but Manson's discovery of the carrying agent, a mosquito, though confirmed in India by Maitland, James, and others, has never, to my knowledge, been followed by sufficient practical action. The spirochætes of relapsing fever, though finely studied by Vandyke Carter, of Bombay, many years ago, still require a determination of their carrying agent. Sprue, ankylostomiasis, beri-beri, unclassed fevers, guinea-worm, and other parasites received little official attention. The case of malaria is perhaps the most astonishing. It causes about a third of the admissions into hospital, and a mortality, directly and indirectly, possibly of some millions a year in India; while nothing does more to hamper military, engineering, and agricultural undertakings. Its cause was discovered in 1880 by Laveran in Algeria—a discovery which enabled us generally to make an immediate definite diagnosis with the microscope. Excepting Vandyke Carter's confirmation, in 1887, literally nothing of consequence was done on the subject in India for fifteen years, though during that period the Italians and others were piling research on research. Not only did these momentous advances seem to be quite unknown to the authorities, but they were almost entirely neglected in the hospitals, and not even the necessary microscopes were provided—equivalent to a failure to supply surgeons with instruments.

My own researches on this subject, commenced about 1901, gave several illustrations of these curious defects. Literature and apparatus were for the most part unobtainable, except by purchase from England, and advice or instruction on scientific details were equally hard to acquire, though arrangements for these should have been organised long previously. In 1895 a rich native State asked for my services to investigate the malaria which seriously incommoded its population, and offered to pay the expenses; but the presiding Civil Service genius vetoed the suggestion. I was even refused ordinary leave of absence to undertake researches at my own cost, although my services could easily have been spared. In 1897, just at the moment when I had at last succeeded in cultivating the parasites of malaria in gnats, and after I had reported this important fact, to my surprise I was suddenly ordered off for months to a place where malaria was almost absent. I was then, very wisely, placed on special duty to continue my work, but, a year later, after I had worked out the life-history of the parasites in mosquitoes, as I could not obtain definite assurance that my special duty would be prolonged, I left the country. Before doing so I gave advice as to the best method of dealing with malaria (by appropriate drainage), but for years no serious effort was made to act upon the advice. It is, or was, usual to thank officers who had been placed on special duty for their services if successful, but mine, I suppose, were not thought to be sufficiently important for this little *douceur*.

I have mentioned some cases of neglect to recognise work done because they involve an important general principle. A scientific administration, if it cannot afford to pay for research, would at least attempt to encourage voluntary investigations by such inexpensive methods as promotion, good conduct pensions, special thanks, and recommendations for State honours. But I cannot remember a single instance in British administration in which the two former have been given for medical researches, even of the most distinguished character (though it is done in America); while the two latter, if offered at all, are offered on the lowest scale. While soldiers, judges, and governors who have merely performed their

ordinary duty are often covered with decorations in consequence, the men whose exceptional work will affect the lives of millions now and in the future are not considered good enough. Even in the medical profession it is generally the practitioner, who is already rewarded by his fees, rather than the pioneer, who is lucky if he is not ruined, who receives most of the public recognition. I may add that there are cases where men have actually suffered for their investigations. Many years ago, King, of Madras, succeeded in preparing a good vaccine from a calf inoculated with variola, but was immediately accused of trying to disseminate small-pox, was deprived of his appointment, and was not reinstated without strong efforts on the part of his friends. More recently, Haffkine, in spite of his immense services, lost his appointment because some cases of tetanus poisoning were attributed to his plague prophylactic; and still remains out of employment, although it has been clearly proved that the disaster was not possibly due to him or to his laboratory. The fact is that the public has little sense of the value of scientific investigations, and absolutely no sense of gratitude towards those who carry them out, usually at the cost of much trouble and expense to themselves.

The obvious retribution for all this childish unwisdom is that the public itself suffers on an enormous scale—millions sicken or die from diseases which a little more investigation and scientific administration would probably bring under comparatively easy control. Perhaps the most dramatic example of this was the terrible outbreak of plague in India in 1896. The people besotted with superstitions, the sanitary organisation insufficiently developed on its scientific side, and the Government knowing nothing of these matters and too weak to exert the necessary discipline, were caught unprepared. Although the disease had been raging for two years previously in Hong Kong, the authorities made no sufficient arrangements to exclude it from India, or to detect and suppress it should it effect an entry. When it came it was allowed to remain undetected for months, and was then met only with vacillating counsels and a painful feebleness of action. Only those who are utterly ignorant of the manner, and the only manner, in which epidemics must be fought against will attempt to justify such a story of ineptitude. The result for India alone has been the loss of more than four millions of lives, and the people are still dying of plague at the rate of seventy-five thousand a week!

In 1897–9 we ascertained definitely that the malarial infection was produced by the bites of mosquitoes, and this discovery immediately disclosed several methods of prevention, such as drainage of the breeding pools of the insects, protection from bites by means of gauze, and so on. Considering that the disease is a most serious, ubiquitous, and continuous pest in most tropical countries, causing an untold amount of inconvenience, expense, sickness and death, we had a right to expect that the new knowledge would be immediately acted upon everywhere for the protection of the public, as all Governments possess sanitary officials and funds specially appointed and allotted for such work. I have been watching the progress of events ever since—with mingled feelings of amusement and dismay. What a tragi-comedy could be written on the subject! There were the officials, there were the funds, there was the knowledge; but to persuade the first to apply the second for the purposes of the third was often an impossibility. They said they had no funds, that they did not accept the proofs, that there was no malaria in their district, that there were no mosquitoes—any and every excuse. The simple truth was that they did not like the trouble. Years passed, but little or nothing was done. The officials remained in undisturbed possession of their leisure. We wrote, lectured, demonstrated, undertook expeditions, sent up deputations, interviewed ministers; but even now, after nearly ten years, but little has been accomplished compared with what might have been done from the first had our Governments possessed those essentials of good administration, science, and discipline. One asks why, if the State thinks it worth while to employ sanitary departments at all, it does not see that they do the work for which they are paid?

Probably a similar state of things prevails in most departments of our administration. Look, for instance, at our large cities with their unspeakable slums filled with pale, dirty, and unhealthy people lounging round the innumerable public houses, or at the crowded mud hovels of the Indian towns—a constant reproach to our systems of municipal management. Then what clearer evidence of the increasing irrationalism, irresolution, and weakness of party government could we have than that given by the successive Vaccination Acts, culminating in the ridiculous "conscientious objection" and "statutory declaration"; or by the appointment of a Royal Commission to consider the utility of experiments on animals—which is like appointing one to consider the truth of the multiplication table? Or, going into another field, we shall find that military men make precisely similar complaints about want of science and discipline in regard to their department, complaints which are certainly causing grave uneasiness among the more thoughtful of our citizens.

To what is all this attributable? In official life it is probably due to the fact that even notorious inefficiency does not always retard advancement, nor even notorious merit accelerate it, with the result that the upper grades are often filled with men of no ideas who have reached their position, not by public services, but by seniority, wire-pulling, or even by the mere inertia of their mediocrity. Going still higher, it is attributable, I think, to our system of party government, because the ministers who should be constantly engaged in a rational State with the organisation and conduct of their departments are, under party government, constantly engaged in that party warfare which, when carried to the present excess, becomes a mere idle game played for the amusement of the mob. Lastly, it is due to our defective public education, which lays too much stress on literary, philological, and dogmatic trifles, and not enough on the hard facts and still harder methods of science, so that the whole nation is tending to become irrational in thought and unpractical in action. We frequently have to look in vain for that wise and strict organisation without which the vast machine of the State cannot perform its proper work. We hear only the jangling of wheels and cranks out of gear, and the cries of the inexpert engineers who think to mend matters by belabouring each other.

Those who have not considered the subject from my point of view will certainly think that there is too much black in this picture, but I could easily cite innumerable more instances, and, personally, have no doubt of my main proposition, that British administration is generally not scientific enough and not strict enough—it does not sufficiently seek knowledge or enforce action. But I do not, of course, deny that it possesses great virtues. It is imperturbable, scrupulous, just, and pure, and, I may add, is rapidly beginning to attach more importance to science. For example, India, which formerly spent, I suppose, less than one-thousandth part of the medical budget on investigation, is now spending perhaps as much as a hundredth part. More laboratories have been equipped, and

there have been official investigations on kala-azar, malaria, Malta fever, plague, typhoid, and other diseases, and on veterinary subjects; the Government has long set an example to other countries in the sale of cheap quinine in malarious areas, and something like a third of many municipal budgets is spent on sanitation, mostly water supply, conservancy, and drainage. Outside India we have recently seen very fine official researches on Malta fever and sleeping-sickness, so that matters are improving. But in my own humble opinion even this is not enough, and I think that the expenditure on research should reach 5 per cent. of that on all medical and sanitary work. Numbers of subjects, such, for example, as measles and scarlet fever in this country, remain almost untouched, greatly to the disadvantage of the public, and in a hundred directions we find action crippled by want of knowledge, and, therefore, correspondingly expensive and inefficient.

But the whole subject of science and the State possesses a most important, and indeed ominous, political significance. The invention of locomotives, by reducing the time required in travelling to about one-third or less, has, so to speak, diminished the world's diameter in the same proportion, and, by bringing the nations more closely face to face, has greatly increased the acuteness of international competition. In this competition scientific organisation becomes more and more vital to success, and in the wars of the last decade we have actually witnessed the complete collapse of two unscientific peoples before their more intelligent adversaries. Now no one will deny that the British stand in the front rank of scientific nations, but it is equally evident that this eminence is due entirely to private individuals, and not at all to the Government, that is, to the party politicians. For years they have allotted only about one three-thousandth part of the national income for scientific work, that is, for obtaining knowledge, equivalent to the annual expenditure for that purpose of six shillings and eightpence by a person possessing a thousand pounds a year; and it may be suggested that the amount of scientific intelligence and knowledge shown in our party political administration should be calculated at about the same rate. Nor can it be contended that the people at large show a much greater interest in science, a much greater knowledge of scientific facts, or a much greater proficiency in scientific habits of thought. Quite recently the Boer war gave us an explicit warning of what such nescience is likely to lead to, and we can only hope that the nation will have the sense to reform its methods in consequence before it is too late. For a full discussion of the subject, however, I must refer the reader to a recent book called "The Problem of National Defence," by my brother, Major Charles Ross, D.S.O. (Hutchinson and Co.), in which he examines from a military standpoint the same defects as I have alluded to above in connection with medical matters. The two cases are really parts of the same problem—how are we to be governed in the future by science rather than by nescience? But whether a nation so wedded to old habits will be able to change in time to save itself is another question which it is impossible to touch upon here.

I fear that some of these remarks will appear to many to be too severe, or perhaps too personal; but I can only state my own opinions, however small their value; and have attempted to do so as frankly as possible, because otherwise there is little use in writing on the subject at all. I should like to add, in conclusion, that my object is not to find fault, but to suggest lines of improvement for the future; and, unfortunately, the one cannot be attempted without the other.

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## INCANDESCENT ELECTRIC LAMPS.[1]

THE closing months of 1906 and the opening months of 1907 are likely to be long remembered by electrical engineers as a period of a remarkable recrudescence of interest in the subject of incandescent electric lamps. For many years the familiar carbon filament lamp has been the only commercial incandescent electric lamp, in spite of its threatened extinction by the invention of the Nernst lamp in 1897–1898. The feeling of uncertainty caused by this discovery was short-lived; after a wealth of prophecy on its probable effect on the industry it was soon found out that months, even years, of experiment were necessary to perfect the Nernst lamps commercially, and the drastic changes recommended to supply engineers were postponed for a time in consequence. Finally, the lamp, capable though it proved of taking a definite place in the art of electric lighting, was found to be hardly even a serious competitor of the carbon filament lamp.

In spite, therefore, of the predictions of 1898, the electrical world settled down with the conviction that the threatened revolution was not destined to be achieved. But in the meantime inventors were busy—foreign inventors that is to say, the English manufacturers being always too busy to invent—and from time to time rumours were heard of other approaching revolutions. Rendered callous, possibly, by the history of the Nernst lamp, little attention was paid to these warnings until the introduction of first the osmium lamp of Dr. Welsbach and then the tantalum lamp of Messrs. Siemens proved the truth of the old saying connecting smoke with fire. Finally came the practical realisation of the tungsten lamp almost simultaneously by Kuzel, Just and Hannaman, and Welsbach, and this for some unknown psychological reason seems to have suddenly awakened English engineers. Once awake they atoned for their long slumber by a copious use of ink, and the technical Press of the period referred to at the beginning of this article simply teems with matter relating to the new lamp developments.

All that is valuable in these articles will be found conveniently crystallised in the papers and discussions in the Journal of the Institution of Electrical Engineers. A paper by Mr. Swinburne on the new lamps opens the latest volume; it is followed by one on light standards and the present condition of high-voltage carbon filament lamps, by Mr. C. Paterson, and the series is rounded off by a paper on carbon filament, Nernst and tantalum lamps, by Messrs. Haworth, Matthewman, and Ogley. Combining these papers with M. Rodet's excellent little book on incandescent electric lamps, the reader can obtain a very fair idea of the present position of this subject.

So far as the carbon filament lamp is concerned, the position is far from satisfactory, as the study of Mr. Paterson's paper shows. It may justly be argued that the test results shown by the author are hardly numerous enough to justify the title. Six lamps each from ten British makers is a small number on which to base a condemnation of British methods, and a lamp-maker who manufactures four or five million lamps a year may rightly complain on being judged by the performance of a chance six. But making all allowance, it must be admitted that there is still much to be desired; nor does it seem probable that a much nearer approach to perfection is likely to be attained without cooperation between manufacturers and supply engineers. To make a lamp for a given voltage to have a definite candle-power and take a definite cur-

[1] "Les Lampes à Incandescence électriques." By J. Rodet. Pp. xi +200. (Paris: Gauthier-Villars, 1907.) Price 6 francs.
"Journal of the Institution of Electrical Engineers." Vol. xxxviii. No. 182. Pp. 211–371. London: E. and F. N. Spon, Ltd., 1907.) Price 5s.